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F4W

F4S

(54) **Multi-mode fan heater**

(57) A multi-mode fan heater (10) having a radiant element (20), reflector means (22) for reflecting heat radiated by said element (20), whereby in a first mode of operation said heater functions substantially as a personal radiant heater, fan means (26) operating at a high capacity in a second mode of operation of said heater to cool said element (20) and significantly reduce the quantity of radiated heat while dispersing air heated by said element (20) to effect space heating.

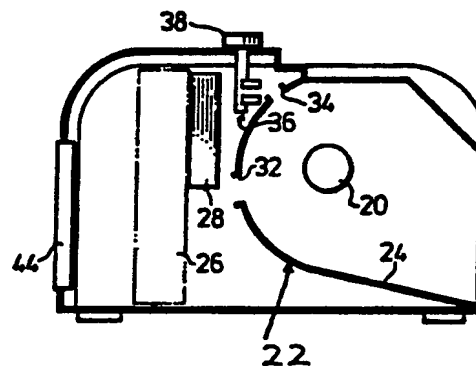
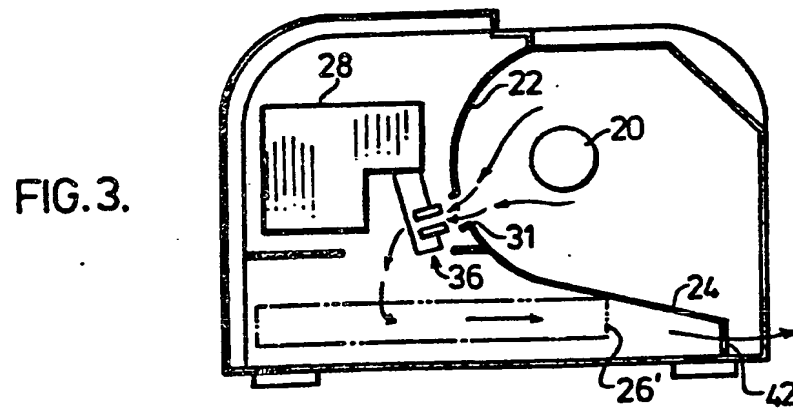
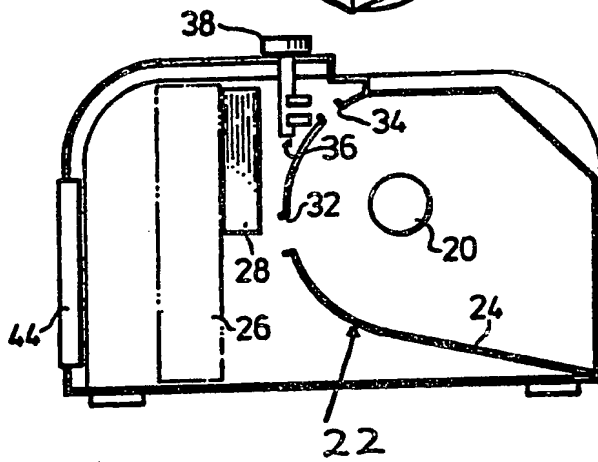
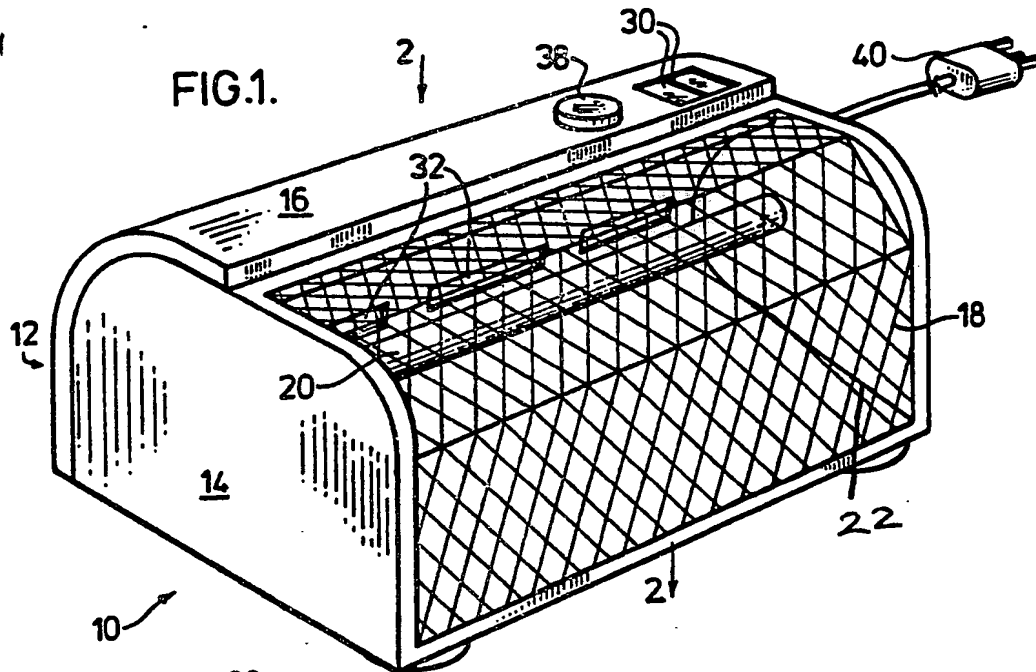


FIG.2.

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SPECIFICATION

Multi-mode fan heater

- 5 This invention is directed to a multi-mode fan heater, which is preferably of the portable type.

Portable electric heaters are well known and highly developed, and generally fall into one of two classes, namely a radiant heater or a space area heater, using forced convection means.

10 Radiant heaters of the quartz element type have recently come onto the market, and because of their relatively local effect are used primarily as a personal heat source. Portable space heaters are also well known and widely used, most usually relying upon a fan effecting a significant dispersal of heated air, to function as a space area heater.

15 Certain types of radiant heaters have in the past utilized a small capacity fan providing local circulation, as means for recirculating air past a thermostat such that in the event of the front of the heater becoming obstructed or in the event of it being placed in too close proximity to a barrier, then the temperature of the recirculated air will rise quite rapidly, causing the protective thermostat of the heater to de-energize the heating element, by disconnecting the electrical connection thereto.

20 The present invention makes provision for a fan means having at least two modes of operation, namely a slow speed mode, as described above for prior art radiant heaters, whereby the temperature of the radiant heating means remains substantially undiminished and the heater functions in the same fashion as other personal radiant heaters. In the other mode, with high speed fan operation, this causes dispersal of heated air generated by the radiant heating means, so as to effect space area heating. This hot air dispersal is effected such that the temperature of the radiant heating means is significantly reduced with a marked reduction in heat radiation.

25 It has been found that the purposes of two quite different heater types may be combined into a single entity, giving the benefits of being able to operate in two quite disparate heater modes, whilst achieving respective outputs in each mode of operation that compare closely with commercial products of the respective type.

30 In accordance with the present invention there is thus provided a multi-mode fan heater having a radiant element, reflector means for reflecting heat radiated by said element, whereby in a first mode of operation said heater functions substantially as a personal radiant heater, and fan means operating in a second mode of operation of said heater to cool said element and significantly reduce the quantity of radiated heat while dispersing air

heated by said element to effect space heating.

35 A preferred embodiment of the invention incorporates fan means including a speed control switch for selecting the mode of operation of the heater. The speed control switch includes a low speed fan setting for operating in a first, radiant heating mode to provide limited local air recirculation within the heater, having thermosensitive control means for sensing the temperature of recirculated air, and being connected electrically in energy controlling relation with the radiant element, to limit energization of that element when a predetermined air temperature of recirculated air is sensed.

40 In the preferred embodiment a generally parabolic reflector is provided having an extended lower leg extending towards the front of the heater, in order to eliminate any undue floor heating effect which can otherwise constitute a fire hazard. The reflector is provided with an air outlet slot or slots substantially horizontally aligned behind the focus of the reflector, so as to discharge air in cooling relation over a radiant heating means such as a resistance heater located at the reflector focus. The reflector is provided with an air inlet in the upper half thereof for recirculation of heater air, there being a thermosensitive sensing element being located in the path of the air flow, behind the reflector and electrically connected in series relation with the energising circuit of the radiant heater.

45 The fan of the preferred embodiment is fitted for dual mode operation having control means for switching the fan from a high capacity blowing mode to a low capacity blowing mode. The dual mode function is generally provided by a multi-speed controller for the fan motor, having a selection switch by means of which a predetermined mode of fan operation is selected.

50 Selection of the low capacity blowing mode causes a low volume of air to circulate past the radiant heating means, so that the temperature of the radiant heating means is maintained at a high value, and the heater functions effectively in a radiation mode. Selection of the high capacity blowing mode causes a high volume of air to circulate past the radiant heating means, thereby dropping its temperature, so as to diminish the radiant output therefrom, while causing the apparatus to dissipate heat primarily by means of hot air dispersal, in a space area heating mode, whereby heat is transferred away from the proximity of the heater, in room heating relation.

55 In the case of operation in either mode where the circulation of air is impeded such that a dangerous temperature rise can ensue, such for instance as the entrainment of curtains at the heater air inlet or outlet, or the positioning of the heater in dangerously close

proximity to an object, the consequent diminution of air flow results in a significant rise in the temperature of air entering behind the reflector. This raises the temperature of the thermosensitive sensor to a sufficient extent to limit or cut off the energization of the heater element.

The invention is illustrated, merely by way of example, in the accompanying drawings wherein:-

Figure 1 is a general view of a portable multi-mode fan heater incorporating the present invention;

Figure 2 is a section end view taken at the plane 2-2 half-way along the heater of *Fig. 1*, and

Figure 3 is a view corresponding to *Fig. 2* of an alternative embodiment.

Referring to *Figs. 1* and *2*, a heater 10 is constituted by a portable appliance having a cabinet 12 with a pair of end walls 14 and an enclosure wall 16. A protective grill wire 18 isolates a radiant heating means or element 20 which may be an electric resistance metal sheathed element. The heating means 20 is illustrated as a metal rodde heating element of the type having the trade made CALROD, the heating means 20 being mounted at the focus of a generally elliptical reflector 22 having an elongated lower leg portion 24 that serves to limit reflected or directly radiated emission onto the floor or other supporting surface.

A fan 26 driven by an electric motor 28 and provided with a selection switch 30 operates in a two or a three speed mode, to circulate air heated by the heating means 20. In the *Figs. 1* and *2* embodiment, air drawn through the fan 26 is blown through slots 32 of reflector 22 in heat transfer relation with the heating means 20. A return flow of heated air enters past the reflector 22, by way of slots 34 therein, the temperature of the return air flow being sensed by a thermosensitive control means 36 having a control knob 38. The control means 36, being in the preferred embodiment a bimetallic thermostat, is connected in series switching relation with the energization circuit of the heating means 20. Thus the control means 36 are connected electrically in energy controlling relation with the heating means 20 to limit energisation of the latter when a predetermined air temperature of recirculated air is sensed.

In operation, with the heater plugged in by way of a cord plug 40 to a suitable outlet (not shown) and the control switch 30 set on a low speed first mode of operation, the rate of air circulation by the fan is sufficiently low that the temperature of the heating means 20 becomes sufficiently high as to function as an effective radiator, wherein the heat generated by the heating means 20 is predominantly reflected forwardly of the heater 10, by means of the reflector 22, whereby the heater

may be used effectively as a personal radiant heater.

Operating the heater 10 in a second mode with the selection switch 30 set for a higher speed, the throughput of air is sufficient to cool the heating means 20 to the extent that it is no longer an efficient radiator, and the heat output is dispersed as hot air, by the fan. The heater 10 thus operates in the second mode as a space area heater.

In *Fig. 3* there is shown a second embodiment of a multi-mode fan heater according to the present invention which is generally similar to that of *Figs. 1* and *2* and which for this reason will not be described in detail, like reference numerals indicating like parts.

In the *Fig. 3* embodiment, however, a fan 26' is arranged to draw air heated by the heating means 20 rearwardly through slots 31, for discharge by the fan 26' forwardly through an outlet 42 located at the front of the heater 10. In this arrangement the thermosensitive control means 36 is located adjacent the slot 31.

Reverting to the *Fig. 2* embodiment, this arrangement lends itself to the provision of an air filter 44 through which air circulates forwardly particularly in the high speed or space area heater mode of operation.

In simulated performance tests, carried out under typical operating conditions, and comparing the performance of the heater of the present invention with that of another brand, when functioning in the "mode 1" low throughput fan operation, as a radiant heater, virtually identical radiant heating was achieved as provided by a typical radiant heater of the type utilizing a quartz heating element.

Operating in the second mode as a space area heater, the heater of the present invention took the same time to heat an enclosed space as that required by a commercial portable space area heater, to heat the same space to the same extent.

Thus, the operation of an embodiment of the multi-purpose heater of the present invention in either of its selected modes has been found to be virtually identical in each instance to a specialty heater designed to operate solely in that particular mode.

Thus, from actual results:

(1) Mode 1—radiant heater: heating a simulated "person" at a distance of 3 feet, (0.9144 m) to effect a temperature rise from 10°C to 20°C, the heater of the present invention required 9 minutes 11 seconds. A quartz radiant heater required 9 minutes 16 seconds to perform the same heating.

(2) Mode 2—space area heater: heating a room 10 feet × 8 feet by 9 1/2 feet high (i.e. 3.048m × 2.4384m × 2.8956 m) from 10°C to 15°C required 12 minutes 30 seconds. A competitive fan heater, for the same effect also required 12 minutes 30 seconds.

The heater of the present invention thus presents a dual capability normally provided only by two separate heaters.

It should be emphasized that mis-using heaters to achieve the "other" function leads to the following results.

(1) using an equivalent radiant heater, operating in the manner of a space area heater, to heat a room requires 33% more time than using the heater of the present invention when operating in its space area heater mode.

(2) operating the heater of the present invention in its radiant heater mode permits heating a "person" in half the time required by an equivalent space heating fan heater.

Thus, it will be seen that the present invention makes readily available the selection of the most effective mode of heating for a given situation, at the touch of a button, using a single portable heater.

The adoption of this invention also permits the use of a wide range of styling formats of acceptable efficiency and attractive appearance.

CLAIMS

1. A multi-mode fan heater having a radiant element, reflector means for reflecting heat radiated by said element, whereby in a first mode of operation said heater functions substantially as a personal radiant heater, and fan means operating in a second mode of operation of said heater to cool said element and significantly reduce the quantity of radiated heat while dispersing air heated by said element to effect space heating.

2. A fan heater as claimed in claim 1, said fan means including speed control switch means for selecting a mode of operation of said heater.

3. A fan heater as claimed in claim 2, said switch means including a low speed fan setting which is employed when operating in said first mode, to provide limited local air recirculation; and thermosensitive control means for sensing the temperature of recirculated air, the control means being connected electrically in energy controlling relation with said radiant element, to limit energization of said element when a predetermined air temperature of recirculated air is sensed.

4. A fan heater as claimed in claim 3 wherein said thermosensitive control means is a thermostat.

5. A fan heater as claimed in any preceding claim wherein said radiant element is an electric resistance metal sheathed element.

6. A fan heater substantially as hereinbefore described with reference to and as shown in Figs. 1 and 2 or Fig. 3 of the accompanying drawings.

7. Any novel integer or step, or combination of integers or steps, hereinbefore described and/or shown in the accompanying drawings irrespective of whether the present

claim is within the scope of, or relates to the same or a different invention from that of, the preceding claims.

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